

AMENDMENTS TO THE DRAWINGS

The attached sheet of drawings includes changes to FIG. 11. This sheet replaces the original sheet including FIG. 11.

ATTACHMENTS: REPLACEMENT SHEETS

A replacement sheet for FIG. 11 is page 16 of this paper.

REMARKS/ARGUMENTS

The amendments and remarks hereto attend to all outstanding issues in the pending office action of 23 June 2005. Claims 1-17 remain pending in this application; of these, claims 12-17 are withdrawn. Claims 1, 4, 5, 7-12 and 14-17 are amended. Claims 25-28 are new.

In the Drawings

FIG. 11 is amended so that reference numeral 301 identifies the correct item in the drawing. Support for this amendment is found in FIG. 1, FIG. 11 and in paragraph [0053] of the specification as filed (paragraph [0053] describes items 2 and 301 as packages; FIG. 1 shows an item 2 that is a package, with item 1 being a PCB).

In the Specification

Paragraph [0053] is amended to correct the reference numerals used in one sentence, to correct a typographical error in the application as filed. Support for the amendment to paragraph [0053] is found in the specification as filed at paragraph [0053] in each of the two sentences that follow the amended sentence.

In the Claims

Claim 1 is amended to clarify that the claimed method comprises forming a solder layer in substantially continuous contact with the conductive base to form a solder bar in the socket and place the microchip in made-ready condition for installation. The amendment to claim 1 finds support at paragraphs [0044] and [0045] of the specification as filed.

Claim 4 is amended to correct a typographical error; the amendment to claim 4 is supported by claim 1 as filed.

Claim 5 is amended to clarify that the step of forming the socket includes forming the socket such that the socket has predetermined dimensions complementary to a microchip connection pad footprint having a geometry selected from the group consisting of rectangular, "E," "L," and "U" shapes. The amendment to claim 5 is supported at least by claims 1 and 5 as originally filed.

Claims 7 and 8 are amended to clarify that forming the solder layer comprises forming a solder bar having a planar rectilinear or a planar curvilinear configuration, respectively. The amendments to claims 7 and 8 are supported at least by claims 7 and 8 as originally filed.

Claims 9 and 10 are amended to effect grammatical corrections.

Claim 11 is amended to add to the group of passivation materials that may be applied. The amendment to claim 11 is supported in the specification as filed at paragraph [0045].

Claim 12 is amended to effect a grammatical correction and to maintain antecedent support from amended claim 1, from which it depends.

Claim 14 is amended to effect a grammatical correction.

Claim 15 is amended to remove one instance of the words “the non-solder base metal” and to add to the group of metals that may be deposited. The amendment to claim 15 is supported in the specification as filed at paragraph [0015].

Claims 16 and 17 are amended to maintain antecedent support from amended claim 1, from which they depend.

New claim 25 reads on species 1b of the Examiner’s restriction requirement, as it is drawn to forming the socket. Claim 25 is supported in the application as filed by FIG. 4 and FIG. 5, which show solder bars 41 and 42 that are associated with sockets 37A and 37B respectively. FIG. 5 shows that each of solder bars 41 and 42, and therefore sockets 37A and 37B, has a length that is at least twice its depth. Claim 25 is believed patentable because it depends from claim 1, argued below as allowable, and because the art of record is believed not to describe, in any combination, forming a socket such that one of a depth and a width of the socket is at least twice the other of the depth and the width.

New claim 26 reads on species 1b of the Examiner’s restriction requirement, as it is drawn to forming the socket. Claim 26 is supported in the application as filed by FIG. 7A and its detailed description at paragraph [0043], which teaches that a solder bar may be planar rectilinear, meaning that a width or a depth dimension of the solder bar may be four times (at least) the height dimension of the solder bar. Claim 26 is believed patentable because it depends from claim 1, argued below as allowable,

and because the art of record is believed not to describe, in any combination, forming a solder bar with a width or a depth that is at least four times the height of the solder bar.

New claims 27 and 28 read on species 1a of the Examiner's restriction requirement, as they are drawn to the microchip. Claims 27 and 28 are supported in the application as filed at paragraph [0045]. Claim 27 is believed patentable because it depends from claim 2, argued below as allowable, and because the art of record is believed not to describe, in any combination, depositing an adhesion layer comprising one of electroplating and screen printing the adhesion layer. Claim 28 is believed patentable because it depends from claim 2, argued below as allowable.

No new matter is added to the application through the addition of any of the claim amendments or new claims herein.

Response to Office Action

Except for the immediately following paragraph, the paragraphs below follow the order of the paragraphs in the Office Action mailed 23 June 2005 in this application.

Office Action Summary

Applicants note that none of the boxes under item (10) on the Office Action Summary page have been checked off, in the current and all previous Office Actions in this application. We are consequently unable to determine whether the drawings are accepted or objected to by the Examiner, and we request an indication thereof in the next Office Action in this application.

Election/Restrictions

Applicants appreciate the Examiner's indication that Applicants' arguments in the Amendment and Response filed 25 April 2005 with respect to groups 1a and 1b were persuasive, and that group 1a and 1b will be merged.

Claim Rejections – 35 U.S.C. §102

Claims 1-12 stand rejected under 35 U.S.C. 102(a) as being anticipated by prior art shown in the application ("AAPA"). Applicant respectfully disagrees. To anticipate a claim, the reference must teach every element of the claim and "the

identical invention must be shown in as complete detail as is contained in the ... claim.” *MPEP 2131* citing *Verdegaal Bros. V. Union Oil Co. of California*, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1987) and *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 9 USPQ2d 1913 (Fed. Cir. 1989).

Applicants’ claim 1, as amended, requires the following step elements in a method of constructing a preformed solder bar made-ready for installing a microchip:

(1) forming a socket on a first surface of a microchip, such that the socket has predetermined physical dimensions complementary to those of a microchip connection pad footprint occupied by at least one contact pad area on the microchip,

(2) the socket presenting a conductive base capable of bonding to solder; and

(3) forming a solder layer in substantially continuous contact with the conductive base to form a solder bar in the socket and place the microchip in made-ready condition for installation.

AAPA does not include, at least, elements (1) or (3) as recited in the claim. With respect to step element (3) of claim 1, the Examiner states that AAPA teaches: “...bonding solder to the conductive base to place a solder bar in the socket and place the microchip in made-ready condition for installation (fig. 2, item 3a).” Office Action, page 2.

First, the Examiner’s characterization of FIG. 2 as showing “the microchip in made-ready condition for installation” is erroneous. FIG. 2 shows a microchip that is fully installed on PCB 1, not in “made-ready condition for installation.” This is an important distinction, because the recitation “made-ready” indicates that the chip is placed in this condition before installation, whereas the AAPA shows an installed chip. Although the Examiner deems this to be admitted prior art, in no context is there an admission as to the made-ready condition of the chip.

Second, the specification describing item 3A does not characterize it as a solder layer or bar, but a solder ball connection: “Package 2 is a ‘Standard CSP,’ which is shown in midsectional top view to reveal a plurality of solder ball connections 3. Solder ball connections 3 attach chip 4 to power plane 5 and ground plane 6...” Specification, paragraph [0034], emphasis added. “Solder balls 3A-3C are interposed between sockets 20A-20C and conductive PCB contacts 22A-22C...”

Specification, paragraph [0035] (as previously amended to correct numbering of sockets 20A-20C), emphasis added.

AAPA also does not show “predetermined physical dimensions complementary to those of a microchip connection pad footprint” as required by element (1) of claim 1. The Examiner states: “... the socket has predetermined physical dimensions complementary to those of a microchip connection pad footprint occupied by at least one contact pad area on the microchip (fig. 2, item 29).” Office Action, page 2. However, this figure does not represent “predetermined physical dimensions complementary to those of a microchip connection pad footprint” for the following reasons.

Examples of what is meant by a “solder bar,” as contrasted to a solder ball, and “dimensions complementary to those of a microchip connection pad” are found in FIG. 4, FIG. 5, FIG. 11 and specification paragraphs [0038] - [0041] and [0049]. For example, the specification includes:

“Solder bars 41, 42 form respective power circuit connections. Solder ball 43 provides data signal or I/O circuit contact and may optionally be used in combination with solder bars 41, 42 or replaced by an additional solder bar. Passivation layer 44 and BCB layer 45 provide a non-conductive base for each of sockets 37A, 37B, 37C. Sockets 37A and 37B have dimensions complementary to solder bars 41, 42 for retention of solder bars 41, 42 therein.” Specification, paragraph [0038], emphasis added.

“Sockets 37A, 37B may be formed by multiple processes; for example by screen printing the adhesion layers 49A, 49B, onto wafer 50, followed by liquid or vapor deposition of passivation layer 44 to a uniform thickness at interface 51.” Specification, paragraph [0039].

FIG. 4 and FIG. 5 each show solder bars 41 and 42 as distinctly different in shape from solder ball 43 (e.g., each of solder bars 41 and 42 is at least twice as wide as solder ball 43). FIG. 4 shows that sockets 37A and 37B have dimensions complementary to microchip pad footprints formed by adhesion layers 49A and 49B, which are complementary to solder bars 41 and 42.

The specification also includes: “FIG. 11 depicts one layout 300 of package 301, which was used in benchmark performance comparison testing against the standard ball-grid package 2 shown in FIG. 1. The two packages 2, 301 differed only in the implementation of plural solder bars 70 (FIG. 7) versus solid balls 3 (FIG. 1).”

Specification, paragraph [0049], emphasis added. FIG. 11 clearly shows solder bars that are at least twice as wide as the solder balls shown in FIG. 1.

Respectfully, comparison of FIG. 11 to FIG. 1 and FIG. 2 also shows that the Examiner's conclusion that "the socket has predetermined physical dimensions complementary to those of a microchip connection pad footprint occupied by at least one contact pad area on the microchip" is erroneous. FIG. 1 shows round solder balls (3) that are each disposed adjacent to a conductive trace on PCB 1. Certain solder balls are seen as disposed on the same conductive traces (e.g., horizontal rows of solder balls are seen as disposed on conductive traces labeled in the drawing as GND or VDDH, or on other, unlabeled traces). A cross-section taken through solder balls along a horizontal line in FIG. 1 would show several solder balls on the same wiring trace. But FIG. 2 shows separations between each of the "wiring traces 24A-24C," which means that the cross-sectional view shown in FIG. 2 is taken along a vertical line, not a horizontal line, in the page orientation of FIG. 1. Therefore solder balls 3 do not show that "the socket has predetermined physical dimensions complementary to those of a microchip connection pad footprint occupied by at least one contact pad area on the microchip." Socket dimensions, as opposed to solder ball dimensions, are simply not shown in FIG. 1, and are shown in only one dimension (the vertical dimension of FIG. 1) in FIG. 2.

FIG. 11, on the other hand, shows solder bars 70 wherein "the socket has predetermined physical dimensions complementary to those of a microchip connection pad footprint occupied by at least one contact pad area on the microchip."

When these drawing features and the specification passages cited above are read and fully appreciated by one skilled in the art, it is evident that sockets 37A and 37B have "predetermined physical dimensions complementary to those of a microchip connection pad footprint occupied by at least one contact pad area on the microchip" while AAPA does not show such dimensions.

For all of the reasons cited above, Applicants request the reconsideration and withdrawal of the rejection of claim 1 as anticipated by AAPA under 35 U.S.C. 102(a).

Claims 2-11 depend directly or indirectly from claim 1 and benefit from like arguments. However, these claims have additional reasons for patentability. For example, claim 2 requires “the step of forming the socket comprises depositing an adhesion layer onto the wafer, and depositing under-bump-metallization (UBM) material contacting the adhesion layer to complete formation of the conductive base.” The Examiner recites the claim elements and references “(figure 2, items 4, 28 and 29).” Office Action, page 2. Applicants note that items 28 and 29 are not an “adhesion layer” or “under-bump metallization (UBM)” but are “BCB layer 28 and passivation layer 29.” Specification, paragraph [0035]. In any case, the AAPA does not teach a step of depositing the adhesion layer onto the wafer, or depositing UBM material contacting the adhesion layer. As noted with respect to claim 1, the AAPA shows an installed chip; an adhesion layer and/or UBM could have been placed thereon by means other than deposition.

Claim 4, as amended, requires that the step of depositing the UBM material include “depositing a conductor selected from at least one of titanium, tungsten, vanadium, tin, copper, aluminum, gold, silver, and lead.” The Examiner recites the claim requirement and references “(specification, paragraph 8).” Office Action, page 3. However, specification paragraph [0008] includes no such teaching:

“[0008] Packages often have different sockets that connect, for example, with low-current, data (I/O) circuits and high-current, power circuits. Both I/O and power circuits utilize solder ball connections. A single solder ball is often inadequate to carry the load of power circuits. Therefore, the load of a power circuit may be shared across a plurality of electrically parallel solder ball connections. Some installations may require additional solder ball connections to provide adequate heat dissipation from the chip.” Specification, paragraph [0008].

There is no disclosure in paragraph [0008] or anywhere else in AAPA that teaches that the step of depositing the UBM material includes depositing a conductor selected from at least one of titanium, tungsten, vanadium, tin, copper, aluminum, gold, silver, and lead.

Claim 5, as amended, requires “the step of forming the socket includes forming the socket such that the socket has predetermined dimensions complementary to a microchip connection pad footprint having a geometry selected from the group consisting of rectangular, ‘E,’ ‘L,’ and ‘U’ shapes.” Applicants believe that the

amendment to claim 5 overcomes the Examiner's rejection, which is based on the "side profile of item 29." Office Action, page 3. Applicants note that item 29 is a passivation layer, not a microchip connection pad footprint or dimensions complementary to a microchip connection pad footprint.

Claim 6 requires "the step of forming the socket includes the physical dimensions selected from the group consisting of ring, square, and circular shapes." The Examiner recites the claim requirement and references "(figure 2, top view of item 20a)." Office Action, page 3. Claim 7, as amended, requires "the step of forming the solder layer comprises forming a solder bar having a planar rectilinear configuration." The Examiner recites the claim requirement and references "(figure 2, side view of item 20a)." Office Action, page 3. Claim 8, as amended, requires "the step of forming the solder layer comprises forming a solder bar having a planar curvilinear configuration." The Examiner recites the claim requirement and references "(figure 2, top view of item 20a)." Office Action, page 3.

However, Applicant's FIG. 2 shows none of the things that the Examiner alleges. First of all, FIG. 2 is explicitly a side view, as stated in the specification: "FIG. 2 shows a side view, of the prior art chip scale package 2." Specification, paragraph [0035]. There is no disclosure of a "top view of item 20a" that the Examiner alleges as support for the rejection of claims 6 and 8. Furthermore, the side view shown in FIG. 2 does not support the Examiner's contention that "forming a solder bar having a planar rectilinear configuration," as required by claim 7, is taught. Item 20A is the socket, not a "solder bar." Item 3A is a solder ball, and is certainly not shown to have a "planar rectilinear configuration" which is taught as "the height dimension extends through a thick film that is substantially planar when the height dimension is several times less, e.g., 4X, 8X, 12X, 16X, less than the width or depth dimension." Specification, paragraph [0043]. On the contrary, FIG. 2 shows that a height dimension of solder ball 3A is roughly comparable to, or even exceeds, its width.

Because claims 2-11 depend directly or indirectly from claim 1, and for all of the additional reasons cited above, Applicants request the reconsideration and withdrawal of the rejection of claims 2-11 as unpatentable over AAPA under 35 U.S.C. 102(a).

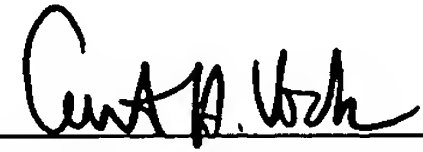
In view of the above Amendments and Remarks, Applicant has addressed all issues raised in the Office Action dated 23 June 2005, and respectfully solicits a Notice of Allowance. Should any issues remain, the Examiner is encouraged to telephone the undersigned attorney.

The \$60 fee for a one month extension of time for a small entity is enclosed. No fee for the newly-submitted claims is believed due, the new claims bringing the current total claims to twenty-one, with twenty-four claims previously paid for. Applicant believes no other fees are currently due, however, if any fee is deemed necessary in connection with this Amendment and Response, please charge Deposit Account No. 12-0600.

Respectfully submitted,

LATHROP & GAGE L.C.

Date: 21 OCT 2005

By: 
Curtis A. Vock, Reg. No. 38,356
Lathrop & Gage L.C.
4845 Pearl East Circle, Suite 300
Boulder, CO 80301
Tele: (720) 931-3011
Fax: (720) 931-3001